- low contamination.

- no application of force.

The reduction of the bond force leads to more careful treatment of the structure wafer and thus to a reduction of the failure probability by direct mechanical loading.

Embodiments of this invention disclose a method for careful production of a permanent bond with a bond force which is as high as possible.

According to an aspect of the present invention, there is provided a method for bonding of a first contact surface of a first substrate to a second contact surface of a second substrate, said method comprising the steps of: forming a reservoir in a surface layer on the first contact surface, wherein the reservoir is formed by plasma activation, wherein species of the ions present in the plasma process are located in the reservoir, after the step of forming the reservoir, at least partially filling of the reservoir with a first educt or a first group of educts, contacting the first contact surface with the second contact surface for formation of a prebond connection, and forming a permanent bond between the first and second contact surface, said permanent bond at least partially strengthened by the reaction of the first educt filled in the reservoir with a second educt contained in a reaction layer of the second substrate.

All combinations of at least two of the features given in the specification, the claims and/or the figures also fall within the framework of the invention. At the given value ranges, values within the indicated limits will also be disclosed as boundary values and will be claimed in any combination.

The basic idea of embodiments of this invention is to devise a reservoir for holding a first educt at least on one of the substrates, to react it after making contact or producing a temporary

Claims

1. A method for bonding of a first contact surface of a first substrate to a second contact surface of a second substrate, said method comprising the steps of:

forming a reservoir in a surface layer on the first contact surface, wherein the reservoir is formed by plasma activation, wherein species of the ions present in the plasma process are located in the reservoir,

after the step of forming the reservoir, at least partially filling of the reservoir with a first educt or a first group of educts,

contacting the first contact surface with the second contact surface for formation of a prebond connection, and

forming a permanent bond between the first and second contact surface, said permanent bond at least partially strengthened by the reaction of the first educt filled in the reservoir with a second educt contained in a reaction layer of the second substrate.

2. The method as claimed in claim 1, wherein formation and/or strengthening of the permanent bond takes place by diffusion of the first educt into the reaction layer.

3. The method as claimed in claim 1, wherein the formation of the permanent bond takes place at a temperature between room temperature and 200° Celsius, especially during a maximum of 1 hour.

4. The method as claimed in claim 1, wherein the permanent bond has a bond strength of greater than 1.5 J/m^2.

5. The method as claimed in claim 1, wherein during the reaction a reaction product with a greater molar volume than the molar volume of the second educts is formed in the reaction layer .

6. The method as claimed in claim 1, wherein the species is any one of oxygen, nitrogen, hydrogen or argon.

7. The method as claimed in claim 1, wherein the surface layer is comprised of an amorphous material and the reaction layer is comprised of an oxidizable material.

8. The method as claimed in claim 1, wherein between the second contact surface and the reaction layer there is a growth layer comprised of native silicon dioxide.

9. The method as claimed in Claim 8, wherein before formation of a permanent bond the growth layer has an average thickness A between 1 angstrom and 10 nm.

10. The method as claimed in claim 1, wherein a reservoir is formed in a vacuum.

11. The method as claimed in claim 1, wherein the reservoir is filled by one or more of the following steps:

exposing the first contact surface to a fluid comprising deionized H_2O and/or H_2O_2, and

exposing the first contact surface to N_2 gas and/or O_2 gas and/or Ar gas and/or forming gas comprising 95% Ar and 5% H_2.

12. The method as claimed in claim 1, wherein the reservoir is formed in an average thickness (R) between 0.1 nm and 25 nm.

13. The method as claimed in claim 1, wherein the average distance (B) between the reservoir and the reaction layer immediately before formation of the permanent bond is between 0.1 nm and 15 nm.

14. The method as claimed in one of the preceding claims, wherein the permanent bond has a bond strength which comprises 2 times the prebond strength.